



How's the weather?

from the Esri GeoInquiries™ collection for Earth Science

Target audience – Earth Science learners

Time required – 15 minutes

Activity	Explore relationships between temperature, pressure, and humidity with daily weather forecasts.
Science Standards	NGSS:MS-ESS2-5 – Collect data to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity.
Learning Outcomes	<ul style="list-style-type: none">• Students will show regional patterns to the pressure of the air around the content.• Students will show how pressure variation and temperature changes can be used to predict upcoming weather.

Map URL: <http://www.esriurl.com/earthgeoinquiry13>

Engage

How do TV weather reporters make their maps?

- Click the link above to launch the map.
- ? Which color indicates high-pressure air? [*The darkest areas of purple represent high pressure.*]
- With the Details button underlined, click the button, Show Contents of Map (Content).
- In the upper-right corner, click the link, Modify Map.
- Click the button, Edit.
- Label the high and low pressure areas on the map. Add at least three low-pressure “L” and three high-pressure “H” symbols. If needed, see the Tooltip on page 2, Edit (Add Features).

Explore

How do air masses generally move across the country?

- Hover over the layer name, Weather Stations.
- Click the button, Change Style.
 - Set Step 1: TempF
 - Set Step 2: Counts & Amounts (Color)
 - Click the button, Options. Set Theme: Above and Below.
 - Click Symbols. Click Fill. Select a Red-to-blue color ramp.
 - If necessary, click Invert Colors to indicate red for warmer and blue for cooler temperatures.
 - Press Ok repeatedly to close menus. Press Done.
- ? Identify states that are particularly warm and cool. [*Warm: KS, TX, FL; Cool: WA, MN*]

Explain

What happens when air masses meet?

- Radiated infrared energy warms air masses over darker ground or at lower latitudes. Warm, moist air expands and rises, and a low-pressure air mass results. Air over lighter-colored ground (like snow) is generally cooler. Air molecules then pack more closely together, making dense, dry, high-pressure air.
- The differential heating of air masses and the pressure difference between them causes the winds to blow. Where two air masses of different temperatures and humidity collide, a *front* is formed. Weather changes occur when two air masses meet along a front. Whether a cold or warm air mass is pushing them determines the type of clouds and weather systems.
- Fronts are symbolized for the air that is coming into an area.
- Click the Edit tool. Then, draw a blue line to indicate where cold air is advancing eastward, and draw a red line to indicate where warm air is advancing eastward. These lines indicate fronts where there are rapid changes in temperature.

more ►

Elaborate

How are precipitation and wind speed studied?

- Air flows from high to low pressure.
- Hover over the layer name, Weather Stations.
- Click the ellipses. Select Copy.
- This creates a new layer named, Weather Stations - Copy.
- On the new layer, change the style.
 - Set Step 1: AVERASPEED
 - Set Step 2: Counts & Amounts (Size)
 - Click Options. Click Symbols, and switch from Shapes to Arrows.
 - Choose any colored downward arrow, and click OK in the symbol box.
 - While still in the Options window, scroll down to check the box by Rotate Symbols.
 - Choose ADIRECTION (which represents the wind direction), and ensure that Geographic is chosen.
 - Click OK, and then click Done.
- ? What direction does wind blow between highs and lows? [*Winds curve outward from highs–clockwise–and then inward toward lows–counterclockwise–in the northern hemisphere.*]

Evaluate

How will air masses affect weather in front of them?

- ? What will the weather be like tomorrow in Boston, Massachusetts, according to the map? [*Boston should be warmer and dry.*]
- ? How should a person in Nebraska dress to go to work or school according to the map? [*Nebraska will start out warm and windy, with cooler weather approaching. There is little chance for precipitation with this change in temperature.*]

EDIT (ADD FEATURES)

- At the top of the map, click the Edit button.
- Click the text marker labeled H or L.
- Click the map, and type in an H or L to indicate high- and low-pressure areas.

CHANGE SYMBOLS

- Click the arrow to the right of the layer, and then click Change Symbols.
- Click the Use arrow to choose the type of symbol.

Next Steps

DID YOU KNOW? ArcGIS Online is a mapping platform freely available to public, private, and home schools. A school subscription provides additional security, privacy, and content features. Learn more about ArcGIS Online and how to get a school subscription at <http://www.esri.com/schools>.

THEN TRY THIS...

- Log in to your ArcGIS organization account.
- To visualize high and low pressure masses, click the Weather Stations More Options button (ellipses). Choose to perform analysis, and then choose Analyze Patterns — Interpolate Points.
- To find areas of rainfall, click the Weather Stations More Options button (ellipses). Choose to perform analysis, and then choose Analyze Patterns — Find Hotspots On The Dewpoint From Temperature field. Areas closer to current dew point are more likely to rain.

TEXT REFERENCES

This GIS map has been cross-referenced to material in the weather sections of chapters from middle-school texts.

- *Earth Science by Glencoe McGraw Hill – Chapter 16*
- *Earth Science by McDougal Littell – Chapter 3*
- *Earth Science by Holt – Chapter 16*
- *Earth Science by Prentice Hall – Chapter 17*